Permit to Construct No. P-2007-0230

Public Comment

Dry Creek Dairy

Hansen, Idaho

Facility ID No. 083-00099

January 24, 2008

Jonathan Pettit

Permit Writer

The purpose of this Statement of Basis is to satisfy the requirements of IDAPA 58.01.01.200, Rules for the Control of Air Pollution in Idaho, for issuing air permits.

Table of Contents

Acronyms, Units, and Chemical Nomenclature

AIRS	Aerometric Information Retrieval System
AQCR	Air Quality Control Region
Btu	British thermal unit
CAA	Clean Air Act
CO	carbon monoxide
DEQ	Department of Environmental Quality
dscf	dry standard cubic feet
EPA	U.S. Environmental Protection Agency
HAPs	hazardous air pollutants
hp	horsepower
IDAPA	a numbering designation for all administrative rules in Idaho promulgated in accordance with the Idaho Administrative Procedures Act
km	kilometer
lb/hr	pound per hour
MMBtu	million British thermal units
NESHAP	Nation Emission Standards for Hazardous Air Pollutants
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NSPS	New Source Performance Standards
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
PTC	permit to construct
PTE	potential to emit
scf	standard cubic feet
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SM	synthetic minor
SO_2	sulfur dioxide
SO_x	sulfur oxides
T/yr	tons per year
UTM	Universal Transverse Mercator
VOC	volatile organic compound

1. FACILITY INFORMATION

1.1 Facility Description

Dry Creek Dairy is proposing to construct an anaerobic digester at Dry Creek dairy. The digester is designed to produce biogas from on-site dairy cattle manure. The resulting biogas will be combusted in three on-site generators that will be used for primary electrical production for the facility and be sold to the local utility.

1.2 Permitting History

This is an initial PTC for this facility.

2. APPLICATION SCOPE

Dry Creek Dairy is proposing to construct an anaerobic digester at Dry Creek dairy that will produce biogas from dairy cattle manure. The biogas will be combusted in three on-site internal combustion engines to produce electricity for the facility and will be sold to the local utility.

2.1 Application Chronology

December 7, 2007	DEQ Received 15-Day Pre-Permit to Construct Approval Application.
December 18, 2007	DEQ denies the 15-Day Pre-Permit to Construct Application
December 20, 2007	DEQ accepts supplemental information for the application and grants 15-Day Pre-Permit to Construct Approval and completeness.
January 14, 2008	DEQ submitted a draft for peer and regional review. Comments were received and incorporated.
January 18, 2008	DEQ submitted a draft for facility review. EPA promulgated a new NSPS for spark ignition internal combustion engines, 40 CFR 60, Subpart JJJJ
January 24, 2008	DEQ submitted a second draft for facility review with incorporation of 40 CFR 60, Subpart JJJJ
January 25, 2008	DEQ Received PTC Processing fee of $7,500.00

3. TECHNICAL ANALYSIS

3.1 Emission Unit and Control Device

Table 3.1 EMISSION UNIT AND CONTROL DEVICE INFORMATION

Emission Unit /ID No.	Description	Control Device
Anaerobic Digester	Capacity: 4.3 million gallon Throughput: 270,000 gallons per day Biogas production: 864,000 cubic feet per day	Internal Combustion Engines (Generator Engines No. 1, 2, and 3)
Generator Engine No. 1	Manufacturer: Guascor Model: SFGLD 560 Rated Power: 750 kW Ignition Type: Spark	None
Generator Engine No. 2		
Generator Engine No. 3		

3.2 Emissions Inventory

See Appendix B for a detailed emission inventory.

TABLE 1.1 WORST-CASE FACILITY WIDE ESTIMATES

Emission Unit	PM_{10}[1]		NO_x[3]		CO[3]		VOC[4]		SO_2[5]	
	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]
Engine No. 1	5.35E-04	2.35E-03	2.32	10.20	5.12	22.43	2.32	10.20	4.02	17.62
Engine No. 2	5.35E-04	2.35E-03	2.32	10.20	5.12	22.43	2.32	10.20	4.02	17.62
Engine No. 3	5.35E-04	2.35E-03	2.32	10.20	5.12	22.43	2.32	10.20	4.02	17.62
TOTAL		**0.01**		**30.6**		**67.29**		**30.6**		**52.86**

1. See Eq. 1
2. See Eq. 2
3. See Eq. 3
4. See Eq. 4
5. See Eq. 6
6. Pounds per clock hour
7. Tons per consecutive 12-calendar month period.

3.3 TAP AND HAP EMISSIONS SUMMARY

TAPS	24-hour Average[a]
	lb/hr
Acroline	5.42E-04
Isomers of Xyelene	2.83E-03
Styrene	1.10E-03
Toluene	5.46E-03
HAPS	**Annual Average[a]**
	lb/hr
Acetaldehyde	1.21E-03
Benzene	1.44E-02
Dichloromethane	2.08E-03
Formaldehyde	3.56E-02
Trichloroethylene	4.17E-04
Vinal Chloride	1.17E-03

a. 24-hour average only applies to non-carcinogenic TAPs.
Annual average only applies to carcinogenic TAPs.
b. NA = not applicable.

3.3 Ambient Air Quality Impact Analysis

The facility has demonstrated compliance to DEQ's satisfaction that emissions from this facility will not cause or significantly contribute to a violation of any ambient air quality standard. The facility has also demonstrated compliance to DEQ's satisfaction that emissions increase due to this permitting action will not exceed any AAC or AACC for TAPs. A summary of the modeling analysis can be found in the modeling memo in Appendix B.

4. REGULATORY REVIEW

4.1 Attainment Designation (40 CFR 81.313)

The facility is located in Twin Falls County which is designated as attainment or unclassifiable for PM_{10}, $PM_{2.5}$, CO, NO_2, SO_X, and Ozone. Reference 40 CFR 81.313.

4.2 Permit to Construct (IDAPA 58.01.01.201)

IDAPA 58.01.01.201.....Permit to Construct Required

The facility's proposed project does not meet the permit to construct exemption criteria contained in Sections 220 through 223 of the Rules. Therefore, a PTC is required.

IDAPA 58.01.01.203.....Permit Requirements for New and Modified Stationary Sources

The applicant has shown to the satisfaction of DEQ that the facility will comply with all applicable emissions standards, ambient air quality standards, and toxic increments.

IDAPA 58.01.01.210.....Demonstration of Preconstruction Compliance with Toxic Standards

The applicant has demonstrated preconstruction compliance for all TAPs identified in the permit application.

4.3 Title V Classification (IDAPA 58.01.01.300, 40 CFR Part 70)

Dry Creek Dairy is classified as a minor facility because the facilities potential to emit is less than major source thresholds. The AIRS classification is "B".

4.4 PSD Classification (40 CFR 52.21)

Dry Creek Dairy is classified as a PSD minor facility because without limits on the potential to emit, all emissions are less than PSD major thresholds.

4.5 NSPS Applicability (40 CFR 60)

40 CFR 60, Subpart JJJJ.....Standards of Performance for Stationary Spark Ignition Internal Combustion Engines.

Dry Creek Dairy operates three 750 kW, NSPS non-certified, spark ignition internal combustion engines that exclusively combust biogas that is produced from an on site anaerobic digester.

40 CFR 60.4230 .....Am I subject to this subpart?

Dry Creek Dairy commence construction after June 12, 2006 and the generators were manufactured

after July 1, 2007 and have a capacity greater than 500 HP but less than 1,350 HP. Therefore, in accordance with 40 CFR 60.4230(a)(4)(i), 40 CFR 60, Subpart JJJJ is applicable to Dry Creek Dairy.

40 CFR 60.4231 .....What emission standards must I meet if I am a manufacturer of stationary SI internal combustion engines?

Dry Creek Dairy is an operator of SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4232 .....How long must my engines meet the emission standards if I am a manufacturer of stationary SI internal combustion engines?

Dry Creek Dairy is an operator of SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4233 .....What emission standards must I meet if I am an owner or operator of a stationary SI internal combustion engine?

In accordance with 40 CFR 60.4233(e), as the owner and operators of three SI ICEs that combust digester gas and are greater than 75KW (100 HP) Dry Creek Dairy must comply with the emission standards in 40 CFR 60, Subpart JJJJ, Table 1 as summarized below in Table 4.1:

Table 4.1 Summary of 40 CFR 60, Subpart JJJJ Table 1.

Engine Type and Fuel	Maximum engine power	Manufacturer Date	Emission standards[a]					
			g/HP-hr			ppmvd at 15% O_2		
			NO_x	CO	VOC[b]	NO_x	CO	VOC[b]
Digester Gas (except lean burn 500≥HP<1,350)	HP≥500	7/1/2007	3.0	5.0	1.0	220	610	80
Digester Gas Lean Burn	500≥HP<1,350	1/1/2008	3.0	5.0	1.0	220	610	80

[a] Owners and operators of stationary non-certified SI engines may choose to comply with the emission standards in units of either g/HP-hr **or** ppmvd at 15% O_2.

[b] For the purposes of this subpart, when calculating emissions of volatile organic compounds (VOC), emission of formaldehyde should not be included.

40 CFR 60.4234 .....How long must I meet the emission standards if I am an owner or operator of a stationary SI internal combustion engine?

As the owner and operators of three SI ICEs that combust digester gas, Dry Creek Dairy must operate and maintain these engines that achieve the emission standards as required in 40 CFR 60.4233 over the entire life of the engines.

40 CFR 60.4235 .....What fuel requirements must I meet if I am an owner of operator of a stationary SI gasoline fired engine internal combustion engine subject to this subpart?

As the owner and operators of three SI ICEs that combust digester gas, Dry Creek Dairy is not subject to this section of the rule.

40 CFR 60.4236 .....What is the deadline for importing or installing stationary SI ICE produced in the previous model year?

Dry Creek Dairy will be installing their SI ICE in the year 2008, this section does not apply to this facility be the engine will be installed before the date specified in this section of the subpart.

40 CFR 60.4237 .....What are the monitoring requirements if I am an owner or operator of an emergency stationary SI internal combustion engine?

The engines that Dry Creek Dairy will be installing will be used for primary electrical production and production of electricity that will be sold to the community electrical grid. These engines will not be used in "*emergencies*" as defined in 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4238 .....What are my compliance requirements if I am a manufacturer of a stationary SI internal combustion engines ≤19KW (25HP).

Dry Creek Dairy is an operator of SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4239 .....What are my compliance requirements if I am a manufacturer of stationary SI internal combustion engines >19 KW (25HP) that use gasoline?

Dry Creek Dairy is an operator digester gas fired SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4239 .....What are my compliance requirements if I am a manufacturer of stationary SI internal combustion engines >19KW (25HP) that use gasoline?

Dry Creek Dairy is an operator digester gas fired SI ICEs and not a "Manufacturer" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4240 .....What are my compliance requirements if I am a manufacturer of stationary SI internal combustion engines >19KW (25HP) that are rich burn engines that use LPG?

Dry Creek Dairy is an operator digester gas fired SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4241 .....What are my compliance requirements if I am a manufacturer of stationary SI internal combustion engines participating in the voluntary certification program?

Dry Creek Dairy is an operator digester gas fired SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4242 .....What other requirements must I meet if I am a manufacturer of stationary SI internal combustion engines?

Dry Creek Dairy is an operator digester gas fired SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4243 .....What are my compliance requirements if I am an owner or operator of a stationary SI internal combustion engine?

Dry Creek Dairy is the owner and operator of three SI ICE, digester gas fired, non 40 CFR 60, Subpart JJJJ certified engines and must comply with standards specified in 40 CFR 60.4233(f). Each engine is greater than 500HP. Dry Creek Dairy must keep a maintenance plan and records of conducted maintenance. Dry Creek Dairy must conduct an initial performance test and conduct subsequent performance testing every 8,760 hours or 3-years which ever comes first in accordance with 40 CFR 60.4243(b)(2)(ii). The engines are not equipped with an AFR controller or a three-way catalyst and/or a

non-selective catalytic reduction therefore, 40 CFR 60.4243(g), does not apply.

Each engine is greater than 500HP and manufactured after July 1, 2007 and before July 1, 2008 but is not subject to 40 CFR 60.4233(b) or (c) because these engines are exclusively combusting digester gas and not gasoline or LPG fuels. 40 CFR 60.4243(h) does not apply to this facility.

40 CFR 60.4244 .....What test methods and other procedures must I use if I am an owner or operator of a stationary SI internal combustion engine?

According to 40 CFR 60.4243(b)(2)(ii) by reference of 40 CFR 60.4243(c), Dry Creek Dairy is subject to conduct performance testing. This section specifies the performance test procedures that must be followed. 40 CFR 60, Subpart JJJJ, Table 2 specifies the methods and requirements for performance testing.

40 CFR 60.4245 .....What are my notification, reporting, and recordkeeping requirements if I am an owner or operator of a stationary SI internal combustion engine?

Dry Creek Dairy is the owner and operator of three SI ICE, digester gas fired, non 40 CFR 60, Subpart JJJJ certified engines. This section specifies the notification and recordkeeping requirements. Dry Creek Dairy shall submit all notifications and supporting documentation to EPA and DEQ in accordance with General Provision 7 and this section of 40 CFR 60, Subpart JJJJ.

40 CFR 60.4246 .....What parts of the General Provisions apply to me?

Table 3 of 40 CFR 60, Subpart JJJJ specifies the applicable sections of 40 CFR 60, Appendix A - General Provisions.

40 CFR 60.4247 .....What parts of the mobile source provisions apply to me if I am a manufacturer of stationary SI internal combustion engines?

Dry Creek Dairy is an operator digester gas fired SI ICEs and not a "*Manufacturer*" by definition of 40 CFR 60.4248. This section does not apply to this facility.

40 CFR 60.4248 .....What definitions apply to this subpart?

This section contains definitions that are found throughout this subpart. This section generally applies to the facilities applicability to 40 CFR 60, Subpart JJJJ.4.6

4.6 NESHAP Applicability (40 CFR 61)

The permittee has not proposed any to construct or install any equipment that is defined as an affected emissions unit by NESHAP regulations.

4.7 MACT Applicability (40 CFR 63)

Dry Creek Dairy is not subject to any MACT.

4.8 CAM Applicability (40 CFR 64)

Dry Creek Dairy is not subject to CAM.

4.9 Permit Conditions Review

This section describes only those permit conditions (PC) that have been added, revised, modified or deleted as a result of this permitting action. All other permit conditions remain unchanged.

ANAEROBIC DIGESTER AND ELECTRIC GENERATORS

Permit Condition 2.3
Permit Condition 2.3 establishes a H_2S concentration for the biogas produced in the facility on –site anaerobic digester. The H_2S limit is established to limit the concentration of H_2S that is converted to the form of SO_2 during combustion in the generators, and it is based on the application requested limit. The concentration of H_2S is directly proportional to the SO_2 emission weight rate. Compliance shall be demonstrated through Permit Conditions 2.11, 2.12, and 2.13.

Permit Condition 2.4
Permit Condition 2.4 establishes a 20% opacity limit for the generators stacks, vent, or functionally equivalent opening associated with the Anaerobic Digester and electric generators. Compliance shall be demonstrated through Permit Condition 2.16.

Permit Condition 2.6, 2.7, 2.17, 2.18, 2.19, and 2.20
Permit Condition 2.6, 2.7, 2.16, 2.17, 2.18, and 2.19 incorporated 40 CFR 60, Subpart JJJJ – Standards of performance for stationary spark ignition internal combustion engines. See section 4.5 "NSPS Applicability (40 CFR 60)" of this statement of basis for a detailed review.

Permit Condition 2.8
Permit Condition 2.8 establishes that only the fuel produced by the anaerobic digester shall be combusted in the generators. The applicant did not propose any alternative fuel. Compliance shall be demonstrated through permit condition 2.12.

Permit Condition 2.9
Permit Condition 2.9 establishes that the biogas produced by the anaerobic digester shall be combusted in the generators or flared in order to prevent methane and H_2S from escaping into the atmosphere. Compliance shall be demonstrated through permit conditions 2.15.

Permit Condition 2.10
Permit Condition 2.10 establishes that digester flare shall have a pilot flame in order to assure proper working order of the flare. This permit condition is considered a reasonable condition in accordance with IDAPA 58.01.01.211.01.c. Compliance shall be demonstrated through permit conditions 2.11 and 2.14.

Permit Condition 2.12
Permit Condition 2.12 establishes that the permittee shall monitor and record the amount of biogas being consumed. In the application the applicant stated that 864,000 cubic feet of biogas per day will be produced based on maximum design capacity of the digester. Since 864,000 cubic feet of biogas per day is what all the calculations are based on, Permit Condition 2.12 assures compliance with calculated emissions submitted in the application. Compliance shall be demonstrated through General Provision 7.

Permit Conditions 2.13
Permit Condition 2.13 establishes that the permittee shall install a biogas and H_2S flow rate meter and record flow rates on a weekly basis. The H_2S concentration and the biogas flow rate are monitored and calculated using the mole-to-mole ratio to assure SO_2 emissions compliance with the application. This condition is considered a reasonable condition per IDAPA 58.01.01.211.01.c. Compliance shall be demonstrated through General Provision 7.

Permit Condition 2.13 establishes a monitoring schedule that may be re-evaluated after reaching maximum operating capacity with sufficient H_2S concentration data. The permittee may request to remove the H_2S flow rate monitor by providing data of monthly rolling consecutive 12-months results from the flow rate meter that were collected after reaching maximum production from the anaerobic

digester.

In the future the permittee may request to remove the biogas flow-rate monitor by providing an uncontrolled emission inventory for each of the emission units along with a detailed description of the operation of the emission units and documentation of the generators control efficiency. The permittee shall include at a minimum data demonstrating a weekly rolling consecutive 6-month average. If the permittee proposes to use H_2S concentrations and SO_2 emissions from a similar plant an argument of why the H_2S concentrations and SO_2 emissions are appropriate for use must be provided. At a minimum this would include:

- Proof that the facilities are similar in design and processes (i.e. what are the emission unit specifications, what are the uncontrolled emissions, digester specifications, process material, etc.). This must include a detailed description of the operation of each emission unit including the digester.
- Proof that the digesters digest similar material and quantities.
- Proof of H_2S concentrations and SO_2 emissions are representative of the process material.

Permit Condition 2.14
Permit Condition 2.14 establishes development of an Operations & Maintenance Manual (O&M Manual). The O&M Manual shall describe at a minimum the criteria listed in the permit condition. The purpose of the O&M Manual is to demonstrate the anaerobic digester, generators, H_2S gas monitor and flow meters are in good working order and assure operation is as efficient as practical as described in the permit application.

Permit Condition 2.15
Permit Condition 2.15 establishes that generator engines No.1, No. 2, and No. 3 shall be operated in accordance with the manufacturer specification and recommendations in order to manage the formaldehyde emission as a result of combustion to be maintained below the AACC standard of 7.7E-02µg/m^3 in IDAPA 58.01.01.586. Formaldehyde emissions are a result of incomplete combustion. In order to mitigate excess formaldehyde emissions and assure compliance with IDAPA 58.01.01.586 AACC concentrations, it is imperative that the generator engines are in good working order and assure operation is as efficient as practical.

5. PERMIT FEES

Table 5.1 lists the processing fee associated with this permitting action. The facility is subject to a processing fee of $7,5000.00 because its permitted emissions are more than 100 T/yr in accordance with IDAPA 58.01.01.225. Refer to the chronology for fee receipt dates.

Table 5.1 PTC PROCESSING FEE TABLE

Emissions Inventory			
Pollutant	**Annual Emissions Increase (T/yr)**	**Annual Emissions Reduction (T/yr)**	**Annual Emissions Change (T/yr)**
NO_X	30.6	0	30.6
SO_2	52.9	0	52.9
CO	67.3	0	67.3
PM10	0.0	0	0.0
VOC	30.6	0	30.6
TAPS/HAPS	0.1	0	0.1
Total:	0.0	0	**181.4**

Fee Due	**$7,500.00**		

6. PUBLIC COMMENT

An opportunity for public comment period on the PTC application was provided from December 10, 2007 to January 3, 2008 in accordance with IDAPA 58.01.01.209.01.c. During this time, there were comments on the application and requests for a public comment period on DEQ's proposed action.

APPENDIX A – AIRS INFORMATION

AIRS/AFS[a] FACILITY-WIDE CLASSIFICATION[b] DATA ENTRY FORM

Permittee/Facility Name: **Dry Creek Dairy**
Facility Location: **Hansen, ID**
AIRS Number: **083-00099**

AIR PROGRAM POLLUTANT	SIP	PSD	NSPS (Part 60)	NESHAP (Part 61)	MACT (Part 63)	SM80	TITLE V	AREA CLASSIFICATION A-Attainment U-Unclassified N- Nonattainment
SO_2	B						B	U
NO_x	B						B	U
CO	B						B	U
PM_{10}	B						B	U
PT (Particulate)								
VOC	B						B	U
THAP (Total HAPs)								
			APPLICABLE SUBPART					
			JJJJ					

[a] Aerometric Information Retrieval System (AIRS) Facility Subsystem (AFS)

[b] AIRS/AFS Classification Codes:

A = Actual or potential emissions of a pollutant are above the applicable major source threshold. For HAPs only, class "A" is applied to each pollutant which is at or above the 10 T/yr threshold, **or** each pollutant that is below the 10 T/yr threshold, but contributes to a plant total in excess of 25 T/yr of all HAPs.

SM = Potential emissions fall below applicable major source thresholds if and only if the source complies with federally enforceable regulations or limitations.

B = Actual and potential emissions below all applicable major source thresholds.

C = Class is unknown.

ND = Major source thresholds are not defined (e.g., radionuclides).

Appendix B – Emissions Inventory

Dry Creek Dairy Emissions Calculations

Calculations and inventory developed by DEQ staff

Process Description

Available literature for electricity and heat production using biogas from anaerobic digestion of livestock manure suggests that the composition of biogas comprises of approximately 55 to 70 percent methane (60 to 65 percent is typical), 30-45 percent CO_2, and trace amounts of H_2S, NH_3, and H_2. H_2S concentrations have been seen as low as 1,930 ppm but may reach as high as 6800 ppm. Eq. 5 and Eq. 6 demonstrates the significance of H_2S concentrations related to SO_2 emissions.

TABLE 1.1 WORST-CASE FACILITY WIDE ESTIMATES

Emission Unit	PM_{10}[1]		NO_x[3]		CO[3]		VOC[4]		SO_2[5]	
	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]	lb/hr[6]	T/yr[7]
Engine No. 1	5.35E-04	2.35E-03	2.32	10.20	5.12	22.43	2.32	10.20	4.02	17.62
Engine No. 2	5.35E-04	2.35E-03	2.32	10.20	5.12	22.43	2.32	10.20	4.02	17.62
Engine No. 3	5.35E-04	2.35E-03	2.32	10.20	5.12	22.43	2.32	10.20	4.02	17.62
TOTAL		**0.01**		**30.6**		**67.29**		**30.6**		**52.86**

1. See Eq. 1
2. See Eq. 2
3. See Eq. 3
4. See Eq. 4
5. See Eq. 6
6. Pounds per clock hour
7. Tons per consecutive 12-calendar month period.

Eq. 1 PM_{10}

Based on AP-42 3.2 "Natural Gas-fired Reciprocating Engine" filterable emission factor of 7.71E-05 lb of PM_{10}/MMBtu Produced for 4-Stroke Lean-burn Engines.

Engine No.1: $\frac{6570btu}{bhp-hour} * 1057bhp = \frac{6.94MMBtu}{hr}$

Engine No. 1: $\frac{6.94MMBtu}{hr} * \frac{0.0000771lbs}{MMBtu} = \frac{0.000535lbs}{hr} * \frac{8{,}760hrs}{yr} * \frac{Ton}{2000lbs} = \frac{0.002T}{yr}$

Eq.2 NOx

Based on engine manufacturer data on the combustion of digester gas.

Engine No.1: $\frac{1gram}{bhp-hr} * 1057bhp = \frac{1057grams}{hr} * \frac{lb}{454grains} = \frac{2.32lbs}{hr} and \frac{10.20T}{yr}$

Eq.3 CO

Based on engine manufacturer data on the combustion of digester gas.

Engine No.1: $\frac{2.2grams}{bhp-hr} * 1057bhp = \frac{2325.4grams}{hr} * \frac{lb}{454grams} = \frac{5.12lbs}{hr} and \frac{22.43T}{yr}$

Eq.4 VOC

Based on NMHC from engine manufacturer data on the combustion of digester gas.

Engine No.1: $\frac{1grams}{bhp-hr} * 1057bhp = \frac{1057grams}{hr} * \frac{lb}{454grams} = \frac{2.32lbs}{hr} and \frac{10.20T}{yr}$

EQ. 5 H2S CONVERSATION FROM PPM TO LB/HR

$$\frac{2000\,f^3H_2S(v)}{1.0E^{+06}\,f^3(v)} = \frac{x}{3.3cf/s}; x = \frac{0.0066cfH_2S/s}{379scfGas/lb-mole} = \frac{1.7E^{-05}lbH_2S-mole}{s} * 34.08moleH_2S = \frac{5.93E^{-04}lbH_2S}{s} * \frac{3600s}{hr} = \frac{2.14lbH_2S}{hr}$$

1) 2000ppm H_2S applicant estimate based on a previously constructed facility.
2) 379 scf Gas/lb-mole is a Natural Gas industry constant.
3) 34.08 is the molecular weight of H_2S.
4) By design the digester will produced a maximum of 864,000 cubic feet of biogas per day. Each generator is estimated to consume 288,000 cf/day, 12,000 cf/hr, and 3.3cf/second.

EQ. 6 H_2S CONVERSATION FROM H_2S TO SO_2

$$\frac{2.14lbH_2S}{hr} * \frac{32}{34} = \frac{2.01lbS}{hr};$$

$$\frac{2.01lbS}{32} = 0.06lbmoleS;$$

$$0.06lbmoleSO_2 * 64 = \frac{4.02lbSO_2}{hr};$$

$$\frac{4.02lbSO_2}{hr} * \frac{8760hr}{yr} * \frac{T}{2000lbs} = \frac{17.62TSO_2}{yr}$$

1) 34 is the molecular weight of H_2S
2) 32 is the molecular weight of Sulfur
3) Assumes 100% conversion of H_2S to SO_2 during combustion

TABLE 1.2 WORST-CASE EMISSION ESTIMATES FOR SULFUR COMPOUNDS FOR A SINGLE GENERATOR ENGINE

Pollutant	ppm[1]	lb/hr[2]	T/yr[3]
H_2S	2000[4]	2.14	9.37

[1] Parts per million in biogas
[2] Maximum pound per hour emission rate with 288,000 cf/day of biogas combusted.
[3] Tons per year based on 105,120,000 cf/yr of biogas combusted.

Appendix C – Modeling Analysis

MEMORANDUM

DATE: January 11, 2008

TO: Jonathan Pettit, Air Quality Permitting Analyst, Air Program

FROM: Kevin Schilling, Stationary Source Modeling Coordinator, Air Program

PROJECT NUMBER: P-2007-0230

SUBJECT: Modeling Review for the Dry Creek Dairy Permit to Construct Application for an Anaerobic Digester and Three Electrical Generators

1.0 Summary

Dry Creek Dairy (Dry Creek), submitted a Permit to Construct (PTC) application for an anaerobic digester for processing onsite manure and three Genset electrical generators at their dairy located near Hansen, Idaho. Air quality analyses involving atmospheric dispersion modeling of emissions associated with the modification in operations of the facility were submitted to demonstrate that the modification would not cause or significantly contribute to a violation of any ambient air quality standard (IDAPA 58.01.01.203.02). Kleinfelder, Dry Creek's consultant, conducted the ambient air quality analyses.

A technical review of the submitted air quality analyses was conducted by DEQ. The submitted modeling analyses: 1) utilized appropriate methods and models; 2) was conducted using reasonably accurate or conservative model parameters and input data; 3) adhered to established DEQ guidelines for new source review dispersion modeling; 4) showed either a) that predicted pollutant concentrations from emissions associated with the proposed facility were below significant contribution levels (SCLs); or b) that predicted pollutant concentrations from emissions associated with the facility, when appropriately combined with background concentrations, were below applicable air quality standards at all receptor locations. Table 1 presents key assumptions and results that should be considered in the development of the permit.

Table 1. KEY ASSUMPTIONS USED IN MODELING ANALYSES

Criteria/Assumption/Result	Explanation/Consideration
All modeled pollutant concentrations are well below applicable standards.	No special permit conditions are needed, beyond those normally imposed, to assure compliance.

2.0 Background Information

2.1 Applicable Air Quality Impact Limits and Modeling Requirements

This section identifies applicable ambient air quality limits and analyses used to demonstrate compliance.

2.1.1 Area Classification

The Dry Creek dairy is located near Hansen, Idaho. The area is designated as attainment or unclassifiable for all criteria pollutants.

2.1.2 Significant and Full Impact Analyses

If estimated maximum pollutant impacts to ambient air from the emissions sources associated with the proposed modification exceed the significant contribution levels (SCLs) of Idaho Air Rules Section 120, then a full impact analysis is necessary to demonstrate compliance with National Ambient Air Quality Standards (NAAQS) and Idaho Air Rules Section 203.02. A full NAAQS impact analysis for attainment area pollutants involves adding ambient impacts from facility-wide emissions, and emissions from any nearby co-contributing sources, to DEQ-approved background concentration values that are appropriate for the criteria pollutant/averaging-time at the facility location and the area of significant impact. The resulting maximum pollutant concentrations in ambient air are then compared to the NAAQS listed in Table 2. Table 2 also lists SCLs and specifies the modeled value that must be used for comparison to the NAAQS.

Table 2. APPLICABLE REGULATORY LIMITS

Pollutant	Averaging Period	Significant Contribution Levels[a] ($\mu g/m^3$)[b]	Regulatory Limit[c] ($\mu g/m^3$)	Modeled Value Used[d]
PM_{10}[e]	Annual[f]	1.0	50[g]	Maximum 1st highest[h]
	24-hour	5.0	150[i]	Maximum 6th highest[j]
$PM_{2.5}$[k]	Annual	Not established	15	Use PM_{10} as surrogate
	24-hour	Not established	35	Use PM_{10} as surrogate
Carbon monoxide (CO)	8-hour	500	10,000[i]	Maximum 2nd highest[h]
	1-hour	2,000	40,000[i]	Maximum 2nd highest[h]
Sulfur Dioxide (SO_2)	Annual	1.0	80[g]	Maximum 1st highest[h]
	24-hour	5	365[i]	Maximum 2nd highest[h]
	3-hour	25	1,300[i]	Maximum 2nd highest[h]
Nitrogen Dioxide (NO_2)	Annual	1.0	100[g]	Maximum 1st highest[h]
Lead (Pb)	Quarterly	NA	1.5[l]	Maximum 1st highest[h]

[a]Idaho Air Rules Section 006.120
[b]Micrograms per cubic meter
[c]Idaho Air Rules Section 577 for criteria pollutants
[d]The maximum 1st highest modeled value is always used for significant impact analysis
[e]Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
[f]The annual PM_{10} standard was revoked in 2006. The standard is still listed because compliance with the annual $PM_{2.5}$ standard is demonstrated by a PM_{10} analysis that demonstrates compliance with the revoked PM_{10} standard.
[g]Never expected to be exceeded in any calendar year
[h]Concentration at any modeled receptor
[i]Never expected to be exceeded more than once in any calendar year
[j]Concentration at any modeled receptor when using five years of meteorological data
[k] Particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers
[l]Not to be exceeded more than once per year

New source review requirements for assuring compliance with $PM_{2.5}$ standards have not yet been developed. EPA has asserted through a policy memorandum that compliance with $PM_{2.5}$ standards will be assured through an air quality analysis for the corresponding PM_{10} standard. Although the PM_{10} annual standard was revoked in 2006, compliance with the revoked PM_{10} annual standard must be demonstrated as a surrogate to the annual $PM_{2.5}$ standard.

2.1.3 Toxic Air Pollutant Analyses

Emissions of toxic substances are generally addressed by Idaho Air Rules Section 161:

> *Any contaminant which is by its nature toxic to human or animal life or vegetation shall not be emitted in such quantities or concentrations as to alone, or in combination with other contaminants, injure or unreasonably affect human or animal life or vegetation.*

Permit requirements for toxic air pollutants from new or modified sources are specifically addressed by Idaho Air Rules Section 203.03 and require the applicant to demonstrate to the satisfaction of DEQ the following:

> *Using the methods provided in Section 210, the emissions of toxic air pollutants from the stationary source or modification would not injure or unreasonably affect human or animal life or vegetation as required by Section 161. Compliance with all applicable toxic air pollutant carcinogenic increments and toxic air pollutant non-carcinogenic increments will also demonstrate preconstruction compliance with Section 161 with regards to the pollutants listed in Sections 585 and 586.*

Per Section 210, if the emissions increase associated with a new source or modification exceeds screening emission levels (ELs) of Idaho Air Rules Section 585 or 586, then the ambient impact of the emissions increase must be estimated. If ambient impacts are less than applicable Acceptable Ambient Concentrations (AACs) for non-carcinogens of Idaho Air Rules Section 585 and Acceptable Ambient Concentrations for Carcinogens (AACCs) of Idaho Air Rules Section 586, then compliance with TAP requirements has been demonstrated.

2.2 Background Concentrations

Background concentrations were revised for all areas of Idaho by DEQ in March 2003[1]. Background concentrations in areas where no monitoring data are available were based on monitoring data from areas with similar population density, meteorology, and emissions sources. Default rural/agricultural background concentrations were used based on the landuse in the area. Table 3 lists applicable background concentrations.

Table 3. BACKGROUND CONCENTRATIONS

Pollutant	Averaging Period	Background Concentration ($\mu g/m^3$)[a]
PM_{10}[b]	24-hour	73
	Annual	26
Carbon monoxide (CO)	1-hour	3,600
	8-hour	2,300
Sulfur dioxide (SO_2)	3-hour	34
	24-hour	26
	Annual	8
Nitrogen dioxide (NO_2)	Annual	17
Lead (Pb)	Quarterly	0.03

[a] Micrograms per cubic meter

[b] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers

1 Hardy, Rick and Schilling, Kevin. *Background Concentrations for Use in New Source Review Dispersion Modeling*. Memorandum to Mary Anderson, March 14, 2003.

3.0 Modeling Impact Assessment

3.1 Modeling Methodology

Kleinfelder used SCREEN3 to assess air quality impacts for facility operations. Table 4 lists the modeling parameters used in DEQ's analyses.

Table 4. REFINED MODELING PARAMETERS		
Parameter	**Description/Values**	**Documentation/Addition Description**
Model	SCREEN3	ISCST3 with the PRIME downwash algorithm, version 04269
Meteorological data	Full Meteorology	SCREEN3 generates worst-case meteorology
Terrain	Not Considered	The surrounding area is effectively flat
Building downwash	Considered	Building dimensions were used in SCREEN3 to account for downwash effects
Receptor Grid	Closest Ambient Air Receptor	Considering the distance from source to receptor and the stack height, the maximum impact will occur at the ambient air boundary

3.1.1 Modeling protocol and Methodology

The submitted air impact analyses were conducted by Kleinfelder. A modeling protocol was submitted to DEQ prior to the application. Modeling was generally conducted using methods and data presented in the protocol and the *State of Idaho Air Quality Modeling Guideline*.

3.1.2 Model Selection

SCREEN3 was used to estimate maximum pollutant impacts to ambient air. SCREEN3 is a screening-level model that produces worst-case 1-hour concentrations. Persistence factors are then used to estimate concentrations for other averaging periods.

Table 5 provides the appropriate persistence factors.

Table 5. MODELING PERSISTENCE FACTORS FOR 1-HOUR SCREEN3 RESULTS		
Averaging Period Conversion	**Persistence Factor for Simple Terrain**	**Persistence Factor for Complex Terrain**
1-hour to 3-hour	0.9	0.7
1-hour to 8-hour	0.7	
1-hour to 24-hour	0.4	0.15
1-hour to annual	0.08	0.03

3.1.3 Meteorological Data

SCREEN3 was run using worst-case meteorology generated by the model.

3.1.4 Terrain Effects

Terrain effects on dispersion were not considered in the analyses. Because the area is relatively flat with respect to affects on pollutant dispersion, terrain effects on maximum modeled impacts are minimal.

3.1.5 Facility Layout

A facility plot plan was submitted with the application. This plot plan was used to evaluate the need to include various structures in the analyses and evaluate the closest distance to ambient air from the emissions source.

3.1.6 Building Downwash

The structure housing the generators was included in the modeling analyses to assess plume downwash effects. The application indicated the building has a height of 4.3 meters, a minimum horizontal dimension of 15.2 meters, and a maximum horizontal dimension of 30.5 meters. DEQ did not check building dimensions in the model against those specified in the application materials because of the very low projected ambient impacts associated with the proposed project. Moderate changes in building dimensions will not change the conclusions of the compliance demonstration.

3.1.7 Ambient Air Boundary

The facility property boundary was used as the ambient air boundary in the modeling analyses. DEQ assumed reasonable measure would be implemented to preclude public access. The application indicated the nearest point of public access is approximately 2,000 feet from the emissions stack. This distance was verified through review of the submitted site maps.

3.1.8 Receptor Network

SCREEN3 only provides plume centerline concentrations in the horizontal direction. The model was run to only calculate a concentration at the facility boundary, 1,000 (610 meters) feet from the emissions source. This approach is acceptable because the large distance to the receptor combined with the relatively short stack height will result in maximum concentrations at the boundary. At this distance, concentrations will decrease with increased distance from the source.

Kleinfelder used a receptor height of 1.5 meters and DEQ requires groundlevel receptors at 0.0 meters. Given the distance between the source and the receptor and the low level of modeled impacts, DEQ is confident that correction of this would not change the conclusions of the compliance demonstration.

3.2 Emission Rates

Specific emissions rates were not directly used in the SCREEN3 computer model. A unit emissions rate of 1.0 pounds/hour was used because the application involves only a single source and impacts vary linearly with emissions. Model results were used to generate dispersion factors for specific pollutant emissions. Impacts were calculated by multiplying the dispersion factors by the applicable emissions rates and the persistence factor associated with the averaging period.

3.2.1 Criteria Pollutant Emissions Rates

Table 6 provides criteria pollutant emissions rates used in the modeling analyses. Emissions given are the total rates for all three generators.

Table 6. EMISSIONS RATES USED FOR AIR IMPACT MODELING					
Emissions Point	Description	Emissions Rates[a] (lb/hr)			
		PM_{10}[b]	SO_2[c]	CO[d]	NOx[e]
GEN	Three generators burning digester gas	0.21	11.3	15.4	7.0

[a] Long term rates (annual emissions divided by 8760 hr/yr) are listed in parentheses
[b] Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
[c] Sulfur dioxide
[d] Carbon monoxide
[e] Oxides of nitrogen

3.2.2 TAP Emissions Rates

Table 7 lists applicable TAP emissions associated with the proposed modification that were in excess of the screening emissions level (EL). All TAPs with emissions over the EL were carcinogenic TAPs, requiring modeling to demonstrate compliance with long term AACCs. Emissions of all other TAPs were below applicable screening emissions levels (ELs) and modeling was not required.

Table 7. MODELED TAP EMISSIONS RATES			
Pollutant	Averaging Period	Source-Specific Emissions Rates[a] (lb/hr)[b]	
		GEN	EL
Benzene	annual	1.4 E-2	8.0 E-4
Dichloromethane	annual	2.1 E-3	1.6 E-3
Formaldehyde	annual	3.6 E-2	5.1 E-4
Vinyl Chloride	annual	1.2 E-3	9.4 E-4

[a] Values for TAPs with an annual averaging period are annual values divided by 8760 hour/year
[b] Pounds per hour

3.3 Emission Release Parameters

Table 8 provides emissions release parameters for the analyses, including stack height, stack diameter, exhaust temperature, and exhaust velocity. The application indicated the stack temperature was provided from the equipment manufacturer as being representative of typical conditions and the stack flow velocity was estimated using a software package for sizing the exhaust silencer. The stack parameters appeared within reasonably expected ranges and DEQ did not require additional documentation and verification of values used.

Table 8. EMISSIONS AND STACK PARAMETERS					
Release Point /Location	Source Type	Stack Height (m)[a]	Modeled Diameter (m)	Stack Gas Temp. (K)[b]	Stack Gas Flow Velocity (m/sec)[c]
GEN	Point	6.1	0.305	628	27.8

[a] Meters
[b] Kelvin
[c] Meters per second

3.4 Results for Significant and Full Impact Analyses

SCREEN3 gave a 1-hour concentration of 66.98 $\mu g/m^3$ for modeling a 1.0 pound per hour emissions rate. This results in a dispersion factor of 66.98 $\mu g/m^3$ per lb/hr. Using emissions rates from Table 6 and 7 and persistence factors from Table 5 for applicable averaging periods, the modeling results in Table 9, 10, and 11 were calculated.

Table 9. SIGNIFICANT IMPACT ANALYSES				
Pollutant	**Averaging Period**	**Maximum Modeled Concentration ($\mu g/m^3$)[a]**	**Significant Impact Level ($\mu g/m^3$)**	**Full Impact Analysis Required**
PM_{10}[b]	24-hour	0.702	5.0	No
	Annual	0.140	1.0	No
Sulfur Dioxide (SO_2)	3-hour	85.4	25	Yes
	24-hour	38.0	5	Yes
	Annual	7.6	1.0	Yes
Carbon Monoxide (CO)	1-hour	130	2,000	No
	8-hour	90.9	500	No
Nitrogen Dioxide (NO_2)	Annual	3.54	1.0	Yes

[a] Micrograms per cubic meter
[b] Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers

Table 10 provides a summary of the full impact analyses.

Table 10. FULL IMPACT ANALYSES						
Pollutant	**Averaging Period**	**Modeled Design Concentration ($\mu g/m^3$)[a]**	**Background Concentration ($\mu g/m^3$)**	**Total Impact ($\mu g/m^3$)**	**NAAQS[b] ($\mu g/m^3$)**	**Percent of NAAQS**
Sulfur Dioxide (SO_2)	3-hour	85.4	34	119.4	1,300	9
	24-hour	38.0	26	64.0	365	18
	Annual	7.6	8	15.6	80	20
Nitrogen Dioxide (NO_2)	Annual	3.54	17	20.54	100	21

[a] Micrograms per cubic meter

3.5 Results for TAPs Analyses

Compliance with TAP increments were demonstrated by modeling uncontrolled TAP emissions increases (those TAPs with emissions exceeding the ELs) resulting from operation of the generators. Table 11 summarizes the ambient TAP analyses.

Table 11. RESULTS OF TAP ANALYSES				
TAP	**Averaging Period**	**Maximum Modeled Concentration ($\mu g/m^3$)[a]**	**AACC[b] ($\mu g/m^3$)**	**Percent of AACC**
Benzene	Annual	0.0150	0.12	13
Dichloromethane	Annual	0.0022	0.24	0.9
Formaldehyde	Annual	0.0373	0.077	48
Vinyl Chloride	Annual	0.0012	0.14	0.9

[a] Micrograms per cubic meter
[b] Acceptable Ambient Concentration or Acceptable Ambient Concentration for a Carcinogen

4.0 Conclusions

The ambient air impact analyses demonstrated to DEQ's satisfaction that emissions from the facility will not cause or significantly contribute to a violation of any air quality standard.